under the eyes of the late Dr. Brünnow. He was present in the Berlin Observatory when Neptune was first recognized as a planet, and an early, if not the earliest, notification of its discovery, that reached this country, came from his hand.

It would be tedious to recall all the results that his untiring industry wrought in the department of cometary astronomy. His greatest and best-known work is his classical investigation of the motion of De Vico's comet of short period. The close and eager search that was made for this comet, particularly in 1855, was not successful, and its ultimate career is unknown; but this fact does not detract from the merit of Dr. Brünnow's memoir, on which a lesser reputation might rest. As a calculator of a high order, he will, however, be remembered for his work on the theory of some of the minor planets, as Flora, Victoria, and Iris—a work which to some extent was carried out during his Directorship of the Observatory of Ann Arbor, Michigan, to which he was appointed in 1854. Here, too, he published for a short time a periodical under the title of *Astronomical Notices*. This journal had but a short life, and judging from its rarity must have had but a small circulation. A very different fate attended the publication of his "Lehrbuch der sphärischen Astronomie," first issued in 1851, and which has passed through several editions, been more than once translated, and is everywhere recognized as an authoritative text-book.

In 1865, on the death of Sir W. Hamilton, Dr. Brünnow was appointed Andrews Professor of Astronomy in the University of Dublin and Director of the Dunsink Observatory. The important and original mathematical researches in which his illustrious predecessor had been engaged had not left him sufficient leisure to superintend with activity the affairs of the Observatory; and the work of organizing and of placing it on a modern footing, adequately equipped, fell to the lot of Dr. Brünnow, who proved himself admirably fitted for the task. The South object-glass, which had remained unmounted, was, under Dr. Brünnow's auspices, provided with an equatorial movement, and with it he carried out the researches in stellar parallax which marked alike his assiduity and his competence as an observer. This line of research, thus connected with the Observatory, his successor, Sir Robert Ball, has recognized and pursued with vigour and success. In 1874, Dr. Brünnow retired from the Directorship on account of failing health and eyesight, and he has since lived privately, principally abroad. He died at Heidelberg, in his sixty-seventh year, to the deep regret, not only of his numerous private friends, but of all those who have profited by his teaching, whether as members of his class or students of his valuable contributions to astronomy.

NOTES.

THE Australasian Association for the Advancement of Science will hold its fourth annual meeting at Hobart in January 1892. The first general meeting will take place on January 7, when Sir James Hector will resign the chair, and Sir Robert G. C. Hamilton, Governor of Tasmania and President of the Tasmanian Royal Society, will assume the Presidency, and deliver an address. Visits to places of interest in the immediate neighbourhood of Hobart will be made during the time when the meeting is being held, and afterwards there will be excursions to different places in Tasmania. Application has been made to the New Zealand Shipping Company, and to Shaw, Savill, and Albion Company, for passages at reduced rates to members of the British Association visiting Tasmania to attend the meeting at Hobart, and it is expected that this will be granted.

THE International Electro-Technical Congress was opened at Frankfort-on-the-Main on Tuesday. An address was delivered by Dr. Stephan, Imperial Minister of Post and Telegraphs. Some 650 members, of whom 198 were foreigners, attended the proceedings. After the usual complimentary speeches, the following gentlemen were elected Presidents of the various Sections of the Congress:—Herr Siemens, of Berlin Mr. Preece, of London; M. Hospitalier, of Paris; Signor Ferrares, of Turin; Herr Waltenhofen, of Vienna; and Herr Kohlrausch, of Hanover. It was decided that a special Section should be formed to consider the principles of legislation dealing with electro-technical matters.

THE Crystal Palace Electrical Exhibition, to be opened on January 1 next, has received the sanction of the Board of Trade, and is duly certified as an International Exhibition, under the provisions of the Patents, Designs, and Trade Marks Act, 1883. The exhibits of Her Majesty's Government will include historical telegraphic and electrical apparatus, instruments, and appliances, as well as the modern apparatus and instruments now in use in the Postal Telegraph Department. This exhibit will be arranged under the direction of Mr. W. H. Preece, F.R.S.

IT has been suggested in America that steps should be taken to secure an International Conference of Electricians at the "Columbian World's Fair." "The time and place," says the new Chicago journal, *Electrician*, "are certainly auspicious, and as there are many questions in electrical science that are now awaiting adjudication it would seem that it were only necessary that the invitation be made by the properly constituted bodies to have it meet with the hearty approbation of scientific men everywhere. Could such a Convention be assembled it would do more than any other agency to bring together at the Columbian Exposition the most complete and varied display of electrical apparatus the world ever saw."

THE International Agricultural Congress was opened on Monday at the Hague by M. Méline, the President, who briefly reviewed the labours of the Paris Congress, dwelling upon its great importance to agriculture in general, and pointing out that the results obtained by that meeting would assist the various Governments in the legislative, administrative, and financial problems requiring solution. The conclusions arrived at in Paris were, however, not final, and would be more precisely defined by the present assembly.

WE have received an intimation of the sudden death, from apoplexy, of Dr. L. Just, Professor of Botany at the Polytechnikum, Carlsruhe, and Director of the Botanic Garden belonging to the same institution. Dr. Just was best known to the botanical world through the *Botanischer Jahresbericht*, which has appeared under his name since its foundation in 1874 up to the present time, though he resigned the editorship in 1885.

MR. CHARLES JAMRACH, well known as an importer, breeder, and exporter of all kinds of animals, died last Sunday at his residence in Bow. He was of German parentage, and inherited from his father the business which he conducted with so much energy and intelligence. Many scientific collections, as well as travelling menageries, have been enriched by him with valuable specimens. He showed particular interest in the breeding of long-coated Persian greyhounds, Japanese pugs, and Madagascar cats. The collection he had last formed includes, the *Times* says, young lions, tigers, and dwarf cattle from Burmah.

THE number of visitors to the South Kensington Museum during the last month exceeded 120,000. This is the largest number in any one month since 1883, in which year the Fisheries Exhibition was held opposite to the Museum, on the ground formerly occupied by the Royal Horticultural Society.

THE Staffordshire County Council have appointed Prof. D. E. Jones, B.Sc. (of the University College of Wales, Aberystwyth), as Director of Technical Instruction for Staffordshire.

THE Oxford Delegates responsible for the University Extension work have just published their Annual Report for the year ending July 31, 1891. No fewer than 192 courses of lectures were delivered. Of these, 90 were on historical subjects, 64 on natural science, 33 on literature and art, and 5 on political economy. These figures show a small increase in the number of courses on history and literature, and evidence a marked increase in the attention that is being paid throughout the country to natural science. On the other hand, political economy does not appear to be popular with those who are responsible for the arrangement of the lectures, and this circumstance the Delegates regret. At several centres in the North of England the courses have been regularly attended by many hundreds of artisans, and the funds to defray the expenses of these lectures have been provided by working men societies. The results of the examinations have in many cases been most satisfactory. In the opinion of Mr. York Powell "The paper classed as distinguished would have been accepted in Oxford as distinctly belonging to the honour class; the 'pass' standard is that which would be adopted in the Oxford pass school." Mr. Lodge and Mr. A. H. Johnson bear similar testimony to the efficiency and capacity of the students.

THE *Times* has been printing an interesting correspondence on county museums, and we may hope that the discussion will lead to some practical results. There can be no doubt as to the need for such institutions. Properly organized, they might be of high educational value, and they would preserve for posterity many objects of archæological interest which are now in danger of being either destroyed or lost. The aim of the proposed museums ought, however, as Prof. Flower has urged, to be very clearly defined, and it would be necessary that arrangements should be made for the preparation of good catalogues and labels.

EVERYONE interested in the scientific aspects of agriculture was sorry to hear that Miss Ormerod had felt it necessary to resign her position as consulting entomologist to the Royal Agricultural Society. It is much to be regretted that misunderstandings should have led to the severance of her connection with the Society with which she has so long been honourably associated. Fortunately her work as an entomologist is not to be interrupted, and she will continue to place her knowledge at the service of agriculturists.

THE Department of Agriculture in New South Wales is not likely to complain of lack of work. During the first three months of the Department's existence—March to May 1890—1200 letters were received from farmers and others on matters of agricultural interest; during the same months of this year, 2300 were received and fully answered. During the first five months of the current year, over 1000 letters were written by the Department, giving specific advice on manures, analysis of soils, insect pests, and parasitic diseases, and were gratefully acknowledged; 18,000 Gazettes and Bulletins were distributed, and 7000 circulars sent out.

IN the official statement relating to the work of the British Museum (Natural History) during 1890, reference is made to two new cases which have been placed in the central hall. One of them illustrates external variation according to age, sex, and season, as exemplified in the well-known bird the Ruff (*Machetes pugnax*). The other case is intended to illustrate the subject of protective resemblance and mimicry. The lower part of the case is occupied by a group showing the simplest form of such resemblance, *i.e.* general conformation of colour to habitual surroundings. Various species of mammals, birds, and reptiles, from the Egyptian desert, are arranged upon a ground consisting of the actual rocks and sand among which they were living. These specimens were collected in February 1890, and presented by Mr. F. S. Worthington. In the upper part of the case specimens are exhibited, chiefly from the class of insects in which the imitation both of the form and colour of external objects is carried to various degrees of perfection and complexity. Among these is a group of Indian butterflies (*Kallima inachis*), which, when at rest with their wings closed, present a marvellous resemblance to dead leaves. Still further stages of complexity of imitation are shown in insects which closely resemble, externally, others belonging to different families or even orders, apparently for purposes of protection.

M. E. HECKEL, of Marseilles, has recently described an interesting case of mimicry which may be frequently seen in the south of France. The mimic is a spider, *Thomisus onustus*, which is often found in the flowers of *Convolvulus arvensis*, where it hides itself for the purpose of snaring two Diptera, *Nomioides minutissimus* and *Melithreptus origani*, on which it feeds. Convolvulus is abundant, and three principal colour-variations are met with: there is a white form, a pink one with deep pink spots, and a light pink form with a slight greenishness on the external wall of the corolla. Each of these forms is particularly visited by one of three varieties of *Thomisus*. The variety which visits the greenish form has a green hue, and keeps on the greener part of the corolla; that which lives in the white form is white, with a faint blue cross on the abdomen, and some blue at the end of the legs; the variety which lives in the pink form is pink itself on the prominent parts of the abdomen and legs. If the animal happens to live on *Dahlia versicolor*, the pink turns to red, and if it lives in a yellow flower—*Antirrhinum majus*, for instance—it becomes yellow. At first Prof. Heckel supposed the three varieties of *Thomisus* to be permanent, but he discovered accidentally that any one of these peculiarly coloured spiders, when transferred to a differently coloured flower, assumes the hue of the latter in the course of a few days; and when the pink, white, green, and yellow varieties are confined together in a box, they all become nearly white.

MR. THEODORE BENT, according to a telegram received from him at Cape Town, has good reason to be satisfied with the results of his investigation of the Zimbabye ruins. He is of opinion that the "finds" unmistakably indicate the form of worship, the manner of decoration, and the system of gold smelting practised by the vanished people who inhabited the buildings. He is now visiting other ruins.

THE series of "One Man" photographic exhibitions at the Camera Club is to be continued during the coming winter. According to the Journal of the Club, there will first be an exhibition of photographs by Mr. Ralph W. Robinson. This will be followed by an exhibition of the work of Mr. J. P. Gibson, of Hexham.

AT a meeting of the Meteorological Society of Mauritius on July 30, it was stated that, on June 13 and 14 last, thunderstorms occurred in that island. This, so far as was known, was the first instance of a thunder-storm having taken place since the year 1801. There was a considerable increase of sunspots at about this time, and on June 14 a remarkable magnetic disturbance took place. Photographs of the latter part of the transit of Venus, on May 10 last, were exhibited. At sunrise the planet had already traversed about one-half of its apparent path, and its appearance was perfectly round and intensely black. The time of tangential contact (at egress) was, as nearly as could be ascertained, 8h. 36m. 36s. A number of charts showing the winds and weather experienced by several vessels which encountered cyclones in December, January, and February last were submitted; the greatest of the disturbances which had been experienced of late occurred from February 3–13. At the Observatory the barometer fell from 29·962 inches, at 9h. a.m. on the 1st, to 29·409 inches, at 3h. 25m. a.m. on the 6th. Full details of these cyclones will be published. With reference to the "Atlas of Cyclone Tracks," lately published by the Meteorological Council, Dr. Meldrum stated that the preparation of an appendix was under consideration.

THE Report of the Meteorological Commission of Cape Colony for the year 1890 contains the results of observations taken at 45 principal stations, and monthly and yearly rainfall values at about 300 stations in the colony and neighbouring States. The observations are made chiefly by public officials, and by private gentlemen who lend their aid. Summaries from a selected number of rainfall stations are also published monthly in the *Government Gazette* and in the *Agricultural Journal*. The expenditure for the year was only £378, so that, considering the smallness of the funds available, the results obtained are highly satisfactory; and the cost of instruments, which become the property of the observers after 5 years' continuous observations, is not inconsiderable. The Commission express the hope that their labours may lead to the discovery of the laws which govern the weather in those parts, and ultimately result in the issuing of trustworthy storm warnings. With this view simultaneous observations from various stations are telegraphed to various ports, where they are entered on sketch maps for the information of mariners and others.

A CORRESPONDENT informs us that Dr. Sleich, of Berlin, has found that the subcutaneous injection of distilled water produces sufficient local anæsthesia at the point of insertion to allow small operations, such as opening a boil, to be made without pain.

THE following are some results of Herren Elster and Geitel's recent electric observations on the Sonnblick, described to the Vienna Academy:—The intensity of the most refrangible solar rays, measured by their discharging effect on a negatively electrified surface of amalgamated zinc is about doubled on rising 3100 m. from the lowland. The authors were unable to find other actino-electrically active substances; even pure fresh snow and dry Sonnblick rock were not perceptibly discharged by light. Waterfalls may produce in a valley a negative fall of potential, and to considerable heights (500 m.). The morning maximum in fall of potential, observed regularly between 7 and 9 a.m. in the plain and in Alpine valleys, was absent at 3100 m. Before thunderstorms in July, the positive fall of potential sank gradually, in light showers, to *nil*, at which it remained sometimes two or three hours till completion of the electrical process in the cloud. In thunder-clouds, or on low ground, during a thunderstorm, the atmospheric electricity usually changes sign after a discharge. St. Elmo's fire (negative as often as positive) always accompanied thunderstorms. The observation that negative St. Elmo's fire burns with blue flame, positive with red, was repeatedly confirmed.

IT is well known that the fox possesses an excellent "head for country." Referring to this subject in an interesting article in the current number of the *Zoologist*, Mr. Harting says a fox has been known to return seventy miles to his "earth," and this not once, but three times. He was caught in Yorkshire, and sent into Lancashire to be hunted by the hounds of the late Mr. Fitzherbert Brockholes, of Claughton Hall, Garstang, and his identity was established by his having been marked in the ear by the fox-catcher. This story Mr. Harting had from his friend Captain F. H. Salvin, who was living in Yorkshire at the time, and was well acquainted with Mr. Brockholes, who gave him all the details.

DURING the nesting season the male ostrich seems to be anything but an agreeable creature. In a paper lately read before the Royal Society of Tasmania, Mr. James Andrew says that at that period the bird is most pugnacious, and may only be approached in safety with great precaution. He resents the intrusion of any visitors on his domain, and proves a most formidable opponent. His mode of attack is by a series of kicks. The leg is thrown forwards and outwards, until the foot, armed with a most formidable nail, is high in the air; it is then brought down with terrific force, serious enough to the unhappy human being or animal struck with the flat of the foot, but much worse if the victim be caught and ripped by the toe. Instances are known of men being killed outright by a single kick, and Mr. Andrew remembers, whilst on a visit in the neighbourhood, that on a farm near Graaff Reinet a horse's back was broken by one such blow aimed at its rider. If attacked, a man should never seek safety in flight; a few yards and the bird is within striking distance, and the worst consequences may result. The alternative is to lie flat on the ground, and submit with as much resignation as possible to the inevitable and severe pummelling which it may be expected will be repeated at intervals until a means of escape presents itself, or the bird affords an opportunity of being caught by the neck, which, if tightly held and kept down, prevents much further mischief. Under such circumstances, however, Mr. Andrew has known a bird, with a badly-calculated kick, strike the back of its own head, scattering the brains—"a serious loss of valuable property to the farmer."

WE learn from the Tiflis paper *Caucasus* that during an excursion to the sources of the Jiagdon, which was made recently by several explorers, no fewer than eight glaciers were discovered, six of which are not marked on the 5 versts to the inch map of Caucasus. They have been viewed now and sketched from Styr-khokh Pass. The southern slope of the branch-ridge of the main chain, between the Kazbek and the Syrkhubarzon peak, has also been sketched from the Trussoff's Pass, and it appears that several of the glaciers of this part of the chain are not represented on the great map, while perpetual snow is shown where there is none. The glaciers visited by the party proved to have very much changed their aspect since 1882. Several sulphur and iron carbonate springs were visited in the Trussoff's valley, and several interesting Alpine flowers in bloom were collected on the passes.

A SKETCH of the vegetation of British Baluchistan, with descriptions of new species, published originally in the Linnean Society's Journal, has now been issued separately. The author is Mr. I. H. Lace, who has had the advantage of Mr. W. B. Hemsley's aid.

IN the *Bulletins de la Société d'Anthropologie de Paris* (fourth series, vol. ii. Parts 1 and 2) the subject most prominently dealt with is the slow rate at which the population of France increases. According to the report of a prolonged discussion on this question, there is much difference of opinion as to the causes to which the phenomenon must be attributed. The *Bulletins* also include interesting contributions on the Koubous, a native tribe of Sumatra, by M. Zelle; a series of spoons of various epochs, by M. Capitan; the pre-Columbian ethnography of Venezuela, by Dr. G. Marcano; justice in Ancient Egypt, by M. Ollivier-Beauregard; and religious evolution in the region of the Congo, by M. Clément Rubbens.

THE second part of the Catalogue of Mammalia in the Indian Museum, Calcutta, by Mr. W. L. Sclater, has just been issued. The first part was compiled by Dr. Anderson, the late Superintendent. The total number of species included in the Catalogue amounts to 590, of which 276 are found within the Indian Empire, and 314 are exotic.

THE Smithsonian Institution has issued a set of useful directions, by Leonhard Stejneger, for the use of collectors, who, without being herpetological experts, desire to procure for the U.S. National Museum specimens of the reptiles and batrachians which they may be able to gather in the neighbourhood of their residence or while travelling. The same Institution publishes directions for collecting recent and fossil plants, by F. H. Knowlton; and notes on the preparation of rough skeletons, by F. A. Lucas.

STUDENTS will be glad to welcome the fourth edition of Prof. Milnes Marshall's well-known work on "The Frog: an Introduction to Anatomy, Histology, and Embryology." The author explains that the chapter on embryology has been in great part rewritten, and that some new figures have been added. The entire book has been carefully revised.

THE additions to the Zoological Society's Gardens during the past week include a Dorsal Hyrax (*Hyrax dorsalis*) from Sierra Leone, presented by Mr. Reginald Brett; a Common Polecat (*Mustela putorius*), British, presented by Mr. F. D. Lea Smith; a Ring-necked Parrakeet (*Palæornis torquatus*) from India, presented by Mrs. Bowen; an Australian Thicknee (*Œdicnemus grallarius*) from Australia, presented by Sir Ferdinand von Mueller, C.M.Z.S.; a Manx Shearwater (*Puffinus anglorum*), British, presented by Master Riviere.

OUR ASTRONOMICAL COLUMN.

SOLAR OBSERVATIONS.—In *Comptes rendus* for August 24. Prof. Tacchini gives a *résumé* of the solar observations made at the Observatory of the Roman College during the second quarter of this year. Spots and faculæ have been observed on 73 days, viz. 25 in April, 23 in May, and 25 in June, The following are the results obtained:—

1891.	Relative frequency		Relative magnitude		Number of groups per day.
	of spots.	of days without spots.	of spots.	of faculæ.	
April ...	9·24	0·00 ...	24·56	55·60 ...	2·36
May ...	14·35	0·00 ...	48·14	51·82 ...	4·09
June ...	16·88	0·00 ...	47·00	89·38 ...	3·80

The distribution and magnitude of the prominences observed are as follow:—

1891.	Number of days of observation.	Mean number.	Mean height.	Mean extension.
			″	°
April ...	18 ...	7·50 ...	42·3 ...	1·5
May ...	21 ...	4·62 ...	37·3 ...	1·4
June ...	19 ...	5·53 ...	39·4 ...	1·8

It is worthy of remark that there was a secondary maximum in May in the case of spots, whilst a secondary minimum is indicated by the observations of prominences.

CONNECTION BETWEEN TERRESTRIAL MAGNETISM AND RADIANT SUNLIGHT.—Prof. Frank H. Bigelow contributes a note to the *American Journal of Science* for September, on the causes of the variations of the magnetic needle. He finds, from a discussion of magnetic observations made at thirteen stations during the month of June 1883, that "the permanent magnetic condition of the earth may be principally due to the orbital motion of the earth through the radiant field of sunlight. The rotation of the earth on its axis causes a modification of the direction of the axis of polarization, by diminishing the angle between the two axes, and as the result of the annual motion may cause it to rotate in a secular period about the axis of figure, or if the magnetization has already become set in the body of the earth, may cause a succession of secular waves to sweep over it from east to west, as is shown to be the case in the history of the isogonic lines and the long-period deflections of the needle." This interesting identification of the magnetic and light action of solar radiations is in harmony with the results of the investigations of Maxwell and Hertz. And Prof. Bigelow believes that, by the application of similar considerations to Mercury, he will be able to satisfactorily account for the outstanding motion of this planet's perihelion.

TWO NEW ASTEROIDS.—On August 28, Charlois discovered the 313th minor planet; and Palisa found the 314th two days later.

PHYSICS AT THE BRITISH ASSOCIATION.

THIS Section, as is unfortunately the custom, was housed in an ecclesiastical edifice in which no provision had been made for the exhibition of apparatus or lantern slides by the readers of papers. No doubt, it is impossible always to provide accommodation equal to that furnished two years ago at Newcastle, when the Physical Lecture Theatre of the Durham College of Science, with its appliances, was placed at the disposal of the Section. Still, it should be possible to provide lantern and screen, and provision should be made, when necessary, for partially darkening the room. If there were a guarantee that lantern slides could always be exhibited, many readers of papers would avail themselves of the opportunity to illustrate their communications much more adequately than is possible at present, when the only appliances are a piece of chalk and a diminutive blackboard; *e.g.* on Monday morning the beautiful photographs of Mr. Clayden and Dr. Copeland had to be passed round from hand to hand instead of being exhibited in a manner which would have done justice to their merits. The contents of many of the papers, too, would be much more easily and pleasantly grasped if such a course were adopted.

Unfortunately, some of the leading physicists, notably Sir William Thomson, Lord Rayleigh, and Prof. Fitzgerald, were unable to be present. Prof. Lodge, however, admirably filled the chair, and spared no exertion in the endeavour to clear up points of obscurity or difficulty that arose during the discussion.

In all, some fifty papers and reports were read. In the limited space at our disposal, we regret that it is only possible to refer to communications of general rather than of special scientific interest.

After the President's address on Thursday morning, Prof. Newton communicated a most interesting account of the action of Jupiter on small bodies passing near the planet, in which he showed that if a comet pass in front of Jupiter, owing to the gravitational attraction between the two bodies the kinetic energy of Jupiter will be increased, while that of the comet will be diminished, and may be diminished to such an extent as to cause it to form (though possibly only temporarily) a member of the solar system. On the other hand, if a comet, already a member of the solar system, pass behind Jupiter, the kinetic energy of the planet will be diminished and that of the comet will be increased, and may conceivably be increased under favourable circumstances to such an extent that the comet may no longer remain as a member of the system. Prof. Newton had calculated that of 1,000,000,000 comets from space crossing, in all directions, a sphere equal in diameter to that of Jupiter's orbit, about 1,200 would come near enough to Jupiter to have their period so much diminished as to be less than that of the planet.

Mr. W. E. Wilson read a paper on the absorption of heat in the solar atmosphere, and exhibited some of the apparatus he had used in the investigation. The method of observation employed consisted in allowing the sun's image to transit across the thermo-electric junction of a Boys radio-micrometer. He finds that the solar radiation from the extreme peripheral portion of the disk is distinctly less than that from the central portions. In this respect the sun's radiation differs entirely from that of the moon, in which there is little or no such difference in the illumination of different parts of the surface. This difference is attributable to the absorption of heat in the solar atmosphere, which will necessarily be much more marked for the peripheral than for the central portions of the disk.

Mr. G. H. Bryan presented an elaborate report on researches relative to the second law of thermodynamics, in which is described an exceedingly simple mechanical representation of Carnot's reversible cycle.